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MUTUALISTIC CLEANING BEHAVIOR IN AN AQUATIC BEETLE[1] (COLEOPTERA)

By GEORGE W. FOLKERTS

Interspecific relationships between animals in which one animal cleans the other, or removes parasites or excises injured or diseased portions from its body are known among various groups of organisms. Among vertebrates, often mentioned is the relationship between the African tick birds (*Buphagus* spp.) and numerous ungulates, notably the African buffaloes (*Syncerus* spp.) and certain rhinocerotes. Among the fishes, well known relationships exist between many of the smaller wrasses (Labridae) and a host of other marine organisms, the wrasses always being the cleaners.

In the invertebrate groups, many instances of mutualism are known, although few of these involve cleaner-client relationships. In the Crustacea, one or possibly several species of red or cleaner shrimps (*Hippolysmata* spp.) clean and service species of marine fishes, especially the morays (Muraenidae). In the insects, as far as the writer has been able to ascertain, there have been no definite relationships of this type noted. Some ornithologists have theorized that the anting behavior of birds, in which the birds pick up ants and place them among the feathers, is a relationship of this type. Supposedly, the insects crawl about among the feathers and kill or remove ectoparasites.

During a recent survey of the Hydradephaga of Alabama the writer had occasion to keep living specimens of several species of these aquatic beetles in captivity. One of these, a large dytiscid, *Cybister fimbriolatus* (Say), was placed in a 100 gallon aquarium for observation. Living with it in this tank was a large aquatic salamander, *Amphiuma means* (Garden), commonly called the congo eel. The amphibian had been in captivity for several years and had continually been plagued with a fungus which created lesions on the body and caused a two inch section of the tip of the tail to shrivel and become useless.

Several days after the beetle was introduced into the tank, it was noticed hovering in the vicinity of the salamander. Closer examination revealed that it was chewing on the fungus-ridden tail of the amphibian and feeding on the fungus and damaged flesh. The salamander remained motionless, resting on the bottom languidly, even though some apparently living tissue was being excised by the beetle. After about 20 minutes of this type of activity the beetle ceased feeding and swam slowly to the other end of the tank. Two days later the writer again noticed behavior of this type and it was evident that considerable quantities of fungus and tissue were being removed. Again the beetle ceased feeding after approximately 20 minutes. After a period of nine days, the beetle had entirely removed the diseased portion of the tail, a volume of material estimated at one and three-fourths cubic cms. Close examination of the stump showed no fungus present. The beetle then moved to the smaller, more shallow areas of infection on the animal's body and removed the fungus and necrotic tissue from two of these. Both were circular, about one cm in diameter and involved only the outermost layers of the skin. Seemingly, such activity would cause the salamander some discomfort, but in every case it remained inactive while the beetle fed.

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Cybister fimbriolatus is thought to be a predaceous beetle, feeding on small aquatic organisms of almost any type. In the situation just described, the aquarium contained many animals that were potentially food for the beetle. Among these were dragonfly nymphs, 14 fishes of six species (most less than one and one-half inches in length), two tadpoles, five newts, several small larval salamanders and numerous snails. At no time, as far as the writer could determine, did the coleopteran display any interest in any of these organisms.

Strict cleaner-client relationships are usually of such a nature that the client allows the cleaner to pursue its activities without molestation and remains motionless or almost so as the cleaner works. This seemed to be the case during these observations. When the writer touched infected areas with the finger or the end of a forceps, the amphibian either swam away or vibrated its body rapidly as if trying to shake off the offending object. No movements of this kind were noticed when the beetle was cleaning.

The foregoing observations are not indicative of a highly evolved cleaner-client relationship between these two species, but they do suggest that similar events may occur in nature. Other species of clients may be involved.

It is worthy of note that another smaller dytiscid, *Hydaticus bimarginatus* (Say), present in the tank, was never observed to engage in cleaning activities.

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ON THE NUMBER OF BEMBIDION SPECIES (COLEOPTERA, CARABIDAE) OCCURRING IN NORTH AMERICA

By Carl H. Lindroth

In a review of Part 3 of my "Ground-Beetles of Canada and Alaska" Arnett (1965) gave the total for genus *Bembidion* in North America, according to our present knowledge, as "about 411 species." This figure was apparently obtained by adding the reportedly 16 new species described in my book (actually, there are 21) to the "about 395" mentioned by Ball (1960, p. 113).

It should, however, be taken into account: (a) that a vast number of specific names in this genus, notably among those given by Casey, have been synonymized since Ball made his estimate, and (b) that several species originally described from the Old World have since been discovered in North America.

Bembidion is the largest genus of carabid beetles both in Eurasia and North America and it is of some interest to make a fair calculation of the number of species existing—or at least known. As far as America north of Mexico is concerned, I would like to do this against an historical background showing the main steps of advancement towards a more complete knowledge.